



THE NORTHERNMOST UNIVERSITY
of Technology in Scandinavia

Integrating sustainability into minerals education

Jan Rosenkranz
COBALT Dialogue meeting
Copenhagen
2014-10-08



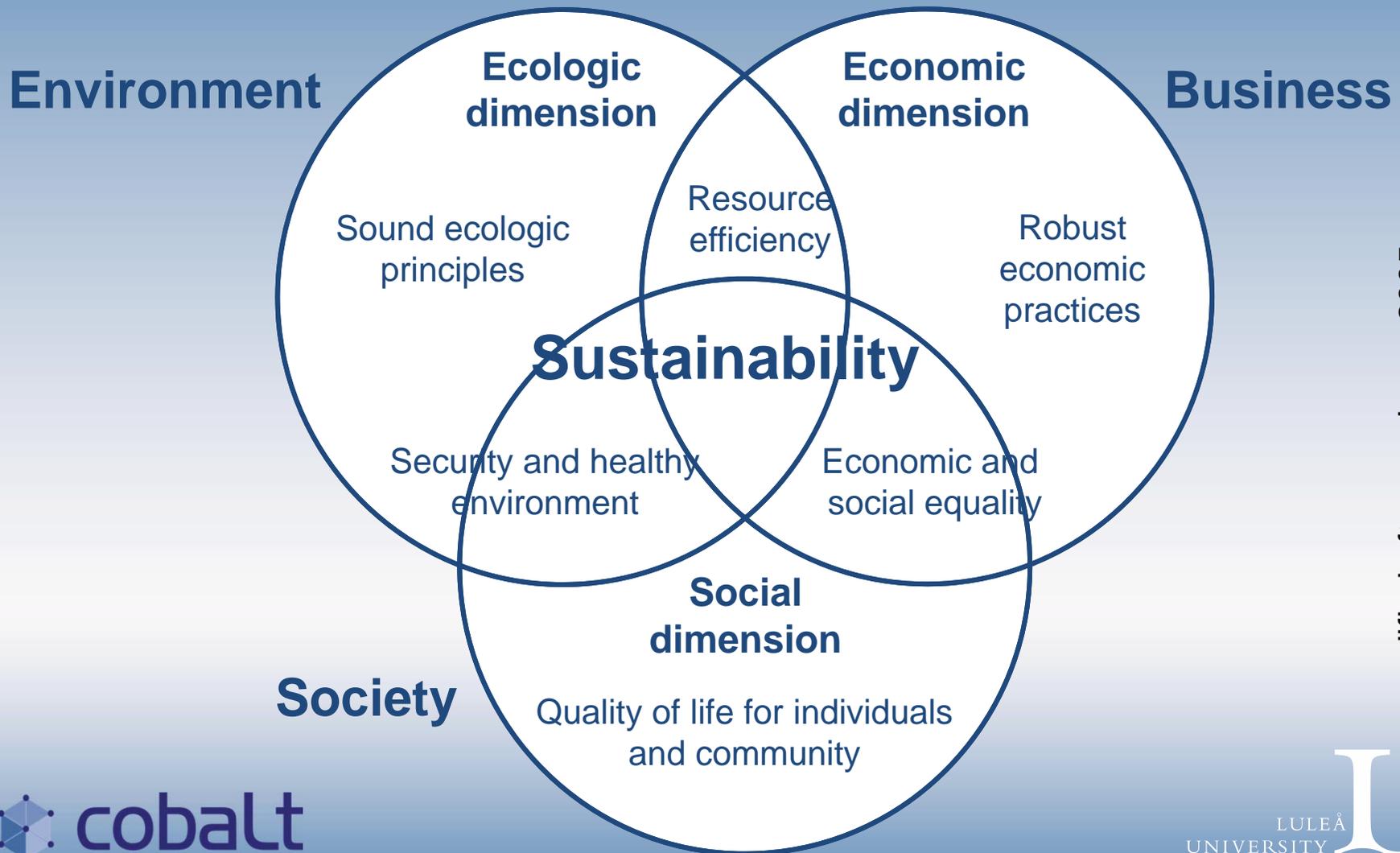


Outline

- Background
- Approaches to integrating sustainability in minerals education
 - A. The Sustainability Working Group concept – An interdisciplinary model for research and education
 - B. Environmental analysis – A course within the MEng programme *Sustainable Process Engineering*
 - C. Geomet@LKAB – An industry course on improving resource efficiency
- COBALT activities within minerals education



Dimensions of sustainability



modified after van Loon, 2005



Responsible mining

- Do extraction and processing of non-renewable resources in a more sustainable manner
- Challenges
 - Sustainable development
 - Community participation in mining
 - Capacity building
 - Environmental impacts
 - Risk communication
 - Concerns of indigenous peoples
 - Land access
 - Conflict and poverty alleviation



Sustainability in minerals education

- Minerals education needs to be integrated with competency in environmental and social sciences
- Minerals education needs to take a holistic perspective:
 - Production chain,
 - Life cycle
 - Broader understanding of economic evaluation, human relations, ethics, safety issues, society / community expectations
- Objective – Educate environmentally literate engineers in mining and minerals engineering
- Challenge – Increasing the environmental content while maintaining high standards in the core disciplines



Course options for environment integration

van Berkel, 2000, Curtin University of Technology

1. Orientation courses

- Familiarise students with SD
- Challenges & opportunities for the mining and minerals processing industry

2. Environmental integration in disciplinary courses

- Modification of existing disciplinary courses
- Application of disciplinary knowledge to environmental projects

3. Specialist environment courses

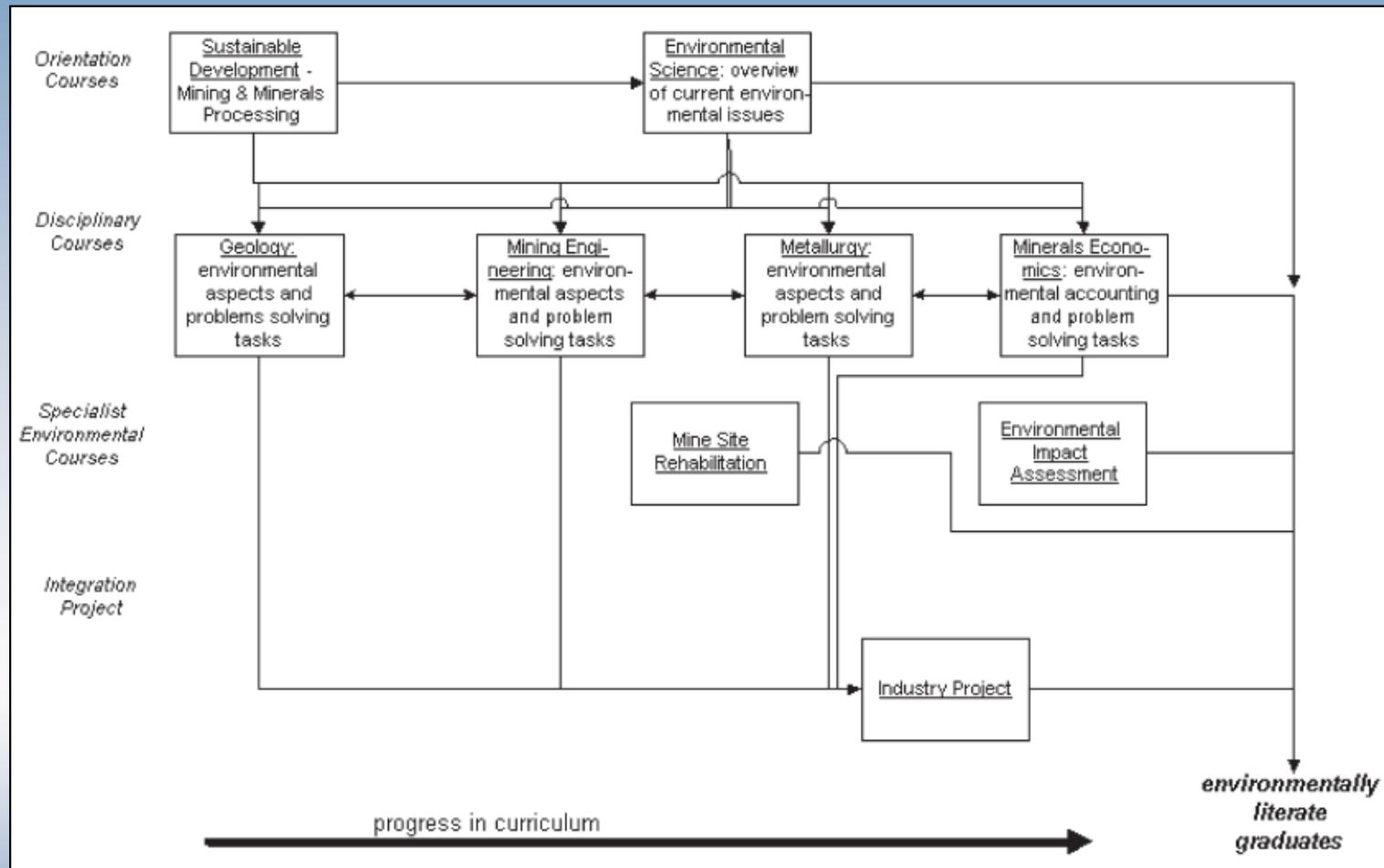
- Environmental science courses
- Application mining and minerals processing

4. Environment relevant project work

- Interdisciplinary group work
- Develop problem-solving skills



Outline for a curriculum



van Berkel, 2000



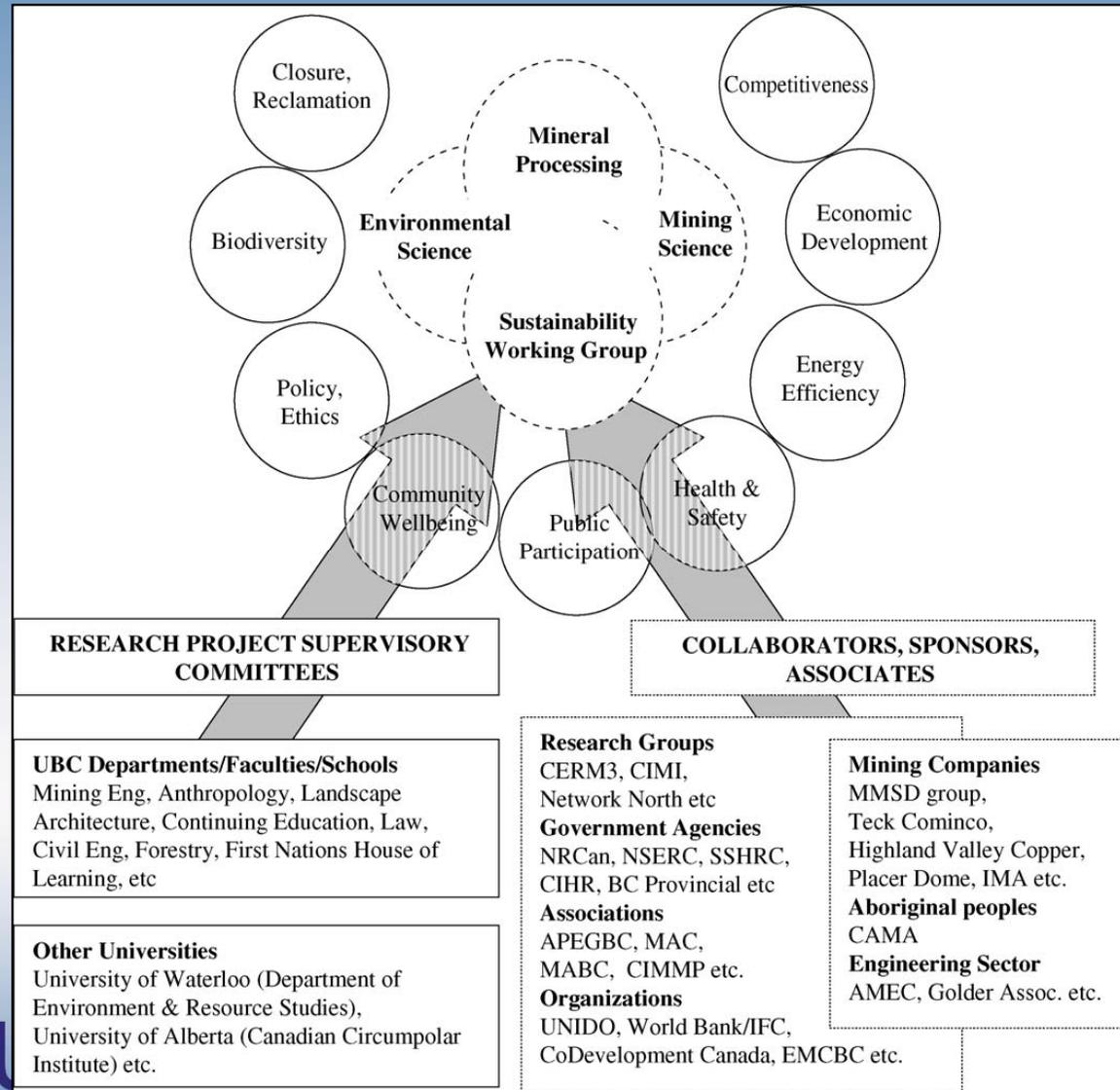
A. Sustainability Working Group model

Costa and Scoble, 2006, University of British Columbia

- Independent model at UBC Mining Engineering Department using the department's own resources
- SWG Group of researchers and practitioners
 - Unique combination of
 - Students and academic professionals, industry professionals, representatives of government and NGOs
 - Skills and experiences
 - mining, mineral processing, geology, environmental science, commerce, geography, landscape architecture, law and anthropology
- Master graduate students: Courses on sustainability, master projects
- Postgraduate students: PhD projects
 - Admission with prior degrees from diverse disciplines
 - Adequate course programme for ensuring basic knowledge of mining engineering

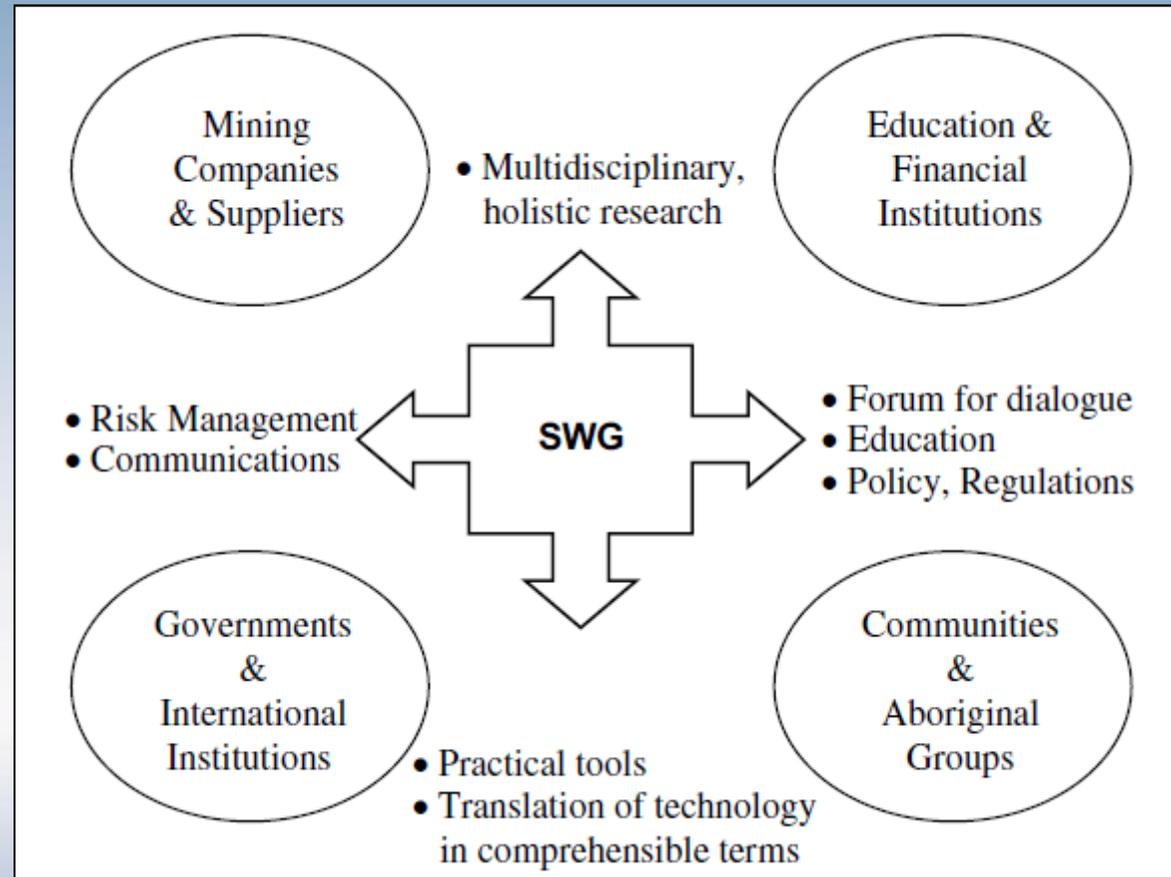


SWG – The concept



Costa and Scoble, 2006

SWG – Scope of activities



Costa and Scoble, 2006



B. Sustainable Process Engineering (LTU)

- Master of engineering study programme (5 years, 300 ECTS, Swedish *civilingenjör*)
 - Bachelor possible after 3 years
 - Internship in industry in the 4th year
 - Specialisations on master level
 - Sustainable mineral and metal extraction
 - Renewable products and fuels
- Carried out in collaboration with industry
 - Scholarships available from Jernkontoret, 50 000 SEK /student
 - Supported and sponsored by industry, mentoring companies
 - LKAB, Boliden AB, SSAB
 - Smurfit Kappa, SCA Svenska Cellulosa Aktiebolaget , Billerud AB



Course M0002K – Environmental analysis

- First cycle, 7.5 ECTS
- Objective
 - Provide knowledge of tools for environmental analysis of process technologies and for critical assessment of the results received
- Content
 - Life cycle analysis
 - Geo-information systems
 - Environmental impact analysis
 - Sustainable development
- Realisation
 - Lectures
 - PC classes: GIS, GaBi (Holistic Balance) software
 - Project work



Project work

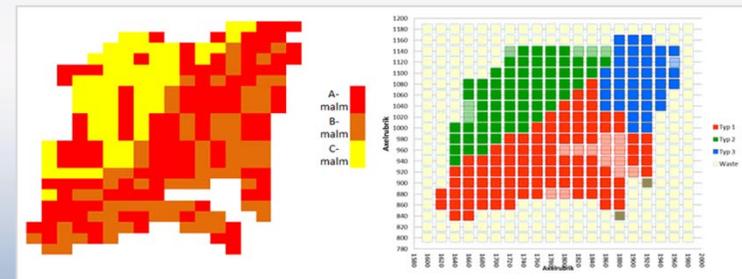
- Case study from minerals or metallurgical industry, e.g. from a steel works
 - Application for permit for extension of an existing production site
 - e.g. Increase in production capacity, bottleneck: coke making plant
 - Data material from application
 - Group work on life cycle analysis and environmental impact analysis
- Review
 - The game: simulating a hearing meeting
 - Groups taking the roles of
 - Industrial company
 - Society groups
 - Authorities
 - Presentation, discussion, applications



C. Geomet@LKAB – An industry course

- Geometallurgy combines geological and metallurgical information to create a spatially-based predictive model for a mineral processing plant to be used in production management
- Interdisciplinary approach to improving resource efficiency
 - Geology, process mineralogy, mineral processing
- Course, advanced level, 7.5 ECTS
 - Participants from the mine, mineral processing & pelletizing plants, R&D
 - Course content from “mine to finished product”
 - Understanding of the link between ore, process and product (common language!)
 - 7 meetings (mix of lectures, exercises and laboratory work following LKAB's processes)

- Introduction, geology
- Process mineralogy I
- Mineral processing
- Process mineralogy II
- Metallurgy and products
- Geometallurgical modeling and simulation
- Workshop





COBALT – WP3 Tackling skill shortages

- Task 3.1: Stock taking of existing courses, identification of skill shortages
- Task 3.2: Course development for different recipient groups and mentoring institutions
 - Development of course syllabi and blueprints for a set of training courses for different regions, recipients and levels
 - Short courses for laypersons “INTRODUCTION TO MINERALS AND METAL PRODUCTION”
 - Block module specialist courses “SUSTAINABLE MINERALS AND METAL PRODUCTION”
 - Full study programme “MINERAL RESOURCE MANAGEMENT IN THE ARCTIC”
- Task 3.3: Pilot testing and dissemination
 - Pilot testing of prototype training courses
 - Course assessment



**Great ideas grow
better below zero**